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Meiosis and Mitosis

Beware of Carbon Tetrachloride

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Co-Editors—RICHARD ARMACOST, Department of Biological Sciences, Purdue University, West Lafayette, Ind.; PAUL KLINGE, Howe High School, Indianapolis 1, Ind.

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Managing Editor—MURIEL BEUSCHLEIN, 6431 S. Richmond, Chicago 29, Ill.

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Teachers and Students Invited

Teachers and students are invited to send in photographs to be used on the cover of future issues of THE AMERICAN BIOLOGY TEACHER. Please enclose brief description along with each picture.

COVER PHOTOGRAPH

A picture of *Amanita muscaria*, sometimes called the fly amanita because the early settlers cut up the poisonous cap and mixed it with sugar to kill flies. It is VERY POISONOUS and there is no known antidote. Dr. A. T. Guard, Department of Biological Sciences at Purdue University, is the photographer responsible for this excellent photograph.

Laboratory Work on Meiosis and Mitosis

JAMES BARNETT
Cambridge, England
and
EDMUND HEY
Magdalen College
Oxford, England

Many who study advanced biology in English schools find it difficult to understand fully the nuclear changes involved in sexual reproduction, although this study is usually part of the syllabus. Probably most teachers hold that laboratory work on mitosis and meiosis is not practicable for school classes. Yet, since chromosome behaviour is entirely outside a pupil's everyday experience, practical work is particularly important as it can help him make better sense of the theory.

The senior biology class at Reading School have been introduced recently to a technique for studying many of the cytological stages of pollen development which needs little technical skill. Using *Tradescantia virginiana*, every pupil has, in a single one and a half hour practical period, prepared from living plants microscope slides showing easily seen stages in pollen mother cell meiosis and first pollen grain mitosis. During a second practical period, some of the students followed up this work by studying pollen tube growth and the second mitotic division of the pollen grain. In this way, pupils were able to find for themselves the exact stage at which each of the nuclear changes takes place in *Tradescantia*: they were able to relate it to the simultaneous anatomical development of the bud and flower, and, probably, come to a clearer understanding both of the details of meiosis and mitosis and of the part they play in reproduction.

Equipment

The methods used are described by Darlington and La Cour (1947). No unusual apparatus is needed:

Microscope (with condenser, 4 mm 16 mm objectives); large dissecting lens; slides and coverslips; solid watch glass and cover; dropping pipette; fine forceps; 2 non-plated mounted iron needles; filter paper; 7% sucrose solution; acetocarmine.

The acetocarmine solution is prepared by adding 45 ml glacial acetic acid to 55 ml distilled water, heating to boiling point and then adding 0.5 g carmine: the solution must be well shaken and finally filtered when cool. Staining may be improved by adding 2 drops of 45% acetic acid saturated with iron acetate; but too much iron precipitates the carmine.

Meiosis in Pollen Mother Cells

Within the anther lobes, each diploid pollen mother cell divides by meiosis into 4 pollen grains. The following procedure is suggested to study this meiotic division.

Taking a bud, about an eighth of an inch long, remove with the fine forceps one or more sepals and petals to uncover the anther lobes. Place the bud on a clean slide, and with a mounted needle squeeze the anther lobes on to the slide. Flood the lobes with 2 or 3 drops of acetocarmine, and then, under a large dissecting lens, tease out each lobe with the iron needles. (Some of the iron dissolves forming iron acetate, which acts as a mordant for the carmine, and this stains the chromosomes more deeply than the cytoplasm.) Then warm the slide gently over a low flame; the solution must not boil. Put a clean coverslip in position and press it down gently between two pieces of filter paper. Too much pressure may squeeze the nuclei out of their cells. The preparation is now complete; it should not have taken more than five minutes. If in this preparation meiosis appears to have finished, and there are only complete uninucleate pollen cells, take a smaller bud and try again; if meiosis has not started, try a larger bud. Meiosis takes place quite quickly, and when a suitable bud has been found it should be

possible to see several stages of meiosis in the same preparation. Meiosis will be found to occur before the anther lobes turn yellow.

First Pollen Grain Mitosis

In *Tradescantia,* the mitosis of the single nucleus of a young pollen cell into the tube nucleus and the longer generative nucleus, occurs when the petals in the buds are beginning to be tinged with colour at their tips. By taking anthers at this stage, the mitosis can be studied easily by the same acetocarmine method. The buds are then usually about one quarter of an inch long and the anther lobes just beginning to turn yellow. For an account of morphological changes corresponding with cytological ones, see Sax and Edmonds (1933).

Pollen Tube Growth

At the beginning of the practical class, some mature anthers should be taken from open *Tradescantia* flowers, and the pollen dusted off into the bottom of a solid watch glass. A few drops of 7% sugar solution are added, and the watch glass is covered to reduce evaporation and protect it from dust. If examined half an hour or so later, well-grown pollen tubes can be seen, and the position of the nuclei may be found by treating with acetocarmine in the usual way. For this purpose, a few grains can be transferred to a microscope slide with a dropping pipette.

The Second Mitotic Division

The generative nucleus divides into 2 male nuclei, one of which may eventually fuse with an egg to form a zygote, and the other with the two polar nuclei to form the endosperm. To observe the mitosis of the generative nucleus, some mature pollen grains may be left to grow in a covered watch glass containing 7% sugar solution for from 12 to 20 hours before examination. Evaporation must be minimized, as it causes a harmful rise in osmotic pressure. If, at intervals, some of the pollen grains are then stained with acetocarmine, it may be possible on examination not only to see the new positions of the nuclei, but also to observe some of the stages of this second mitosis.

Natural Pollen Tube Growth on the Stigma

If the stigma is removed from a flower whose petals are withering, mounted on a slide, stained with acetocarmine, and gently but firmly crushed, pollen grains with growing tubes should be visible amongst the mass of short hairs at the tip of the style. Care must be exercised in squashing, for if insufficient pressure is applied distinct cells will not be visible, but if pressure is too violent the pollen tubes will be broken and the grains pushed away. It is best to squash the style in stages, examining it under the microscope after each attempt. This method does not enable the nuclear changes to be observed as easily as when the pollen is growing in sugar solution, but it gives a picture of what occurs naturally. It may be found sometimes that halving the stigma longitudinally in the first place gives better results.

Tradescantia

Nuclear cytologists have used *Tradescantia* for research, because, amongst other things, it is easy to obtain, has a long flowering period, and has particularly large chromosomes which are readily studied in smear preparations (see Anderson and Woodson, 1935). It is as well to stress to pupils that these are the reasons why they are given this unfamiliar plant as their material. *T. virginiana* is a tetraploid, with a somatic chromosome number of 24 (Anderson, 1937). About half the plants in the British Flora are tetraploids, so this condition is not abnormal.

Although not a native British plant, *Tradescantia* is easy to obtain, for it is cultivated in many gardens. It is a hardy herbaceous perennial with the names of Spiderwort, or Flower of a Day; *T. virginiana* (synonymous with *T. virginica*) is the species most often grown in Britain. Its flowers, usually purple but often blue, white or red, may be found continuously in England between May and October; and since individual flowers, as one of its names implies, remain open for only a single day, all the stages of floral development are available throughout the season. There should be no difficulty in growing the plant in a laboratory garden, and its long flowering season is a useful character. It is found wild in the woods, thickets, meadows, fields and roadsides of the Eastern side of North America, and is said to have been brought to England from Virginia by the son of John Tradescant, King Charles the First's Dutch head gardener. The popular name "Spiderwort" may have

arisen from an old belief in the plant's efficacy in curing the bite of a kind of spider. Anderson and Woodson (1935) discuss the history of this species.

The genus *Tradescantia* is large, and has, on occasions, been split into four or more groups, using such features as the presence or absence of spathe-like bracts or upper leaves subtending the flower, the type of inflorescence, and the number of fertile stamens; (there are usually 6, but often 3 become sterile). An interesting feature is the frequent presence of brightly coloured moniliform hairs with the stamens, making good material for certain cytological demonstrations often mentioned in textbooks, such as the circulation of cytoplasm. These hairs are well-developed in *T. virginiana*.

Tradescantia is a monocotyledon and a member of the Commelinaceae; which is a large, mainly tropical and subtropical group, not closely related to any family well represented in Britain. The Alismataceae have many similar characteristics, as have the Butomaceae and Hydrocharitaceae, although in the latter two some reduction and specialization is found. Hutchinson (1934) claims similarities between the Commelinaceae and such families as the Juncaginaceae, Scheuchzeriaceae, Potamogetonaceae and Zosteraceae; the reduced perianth and other factors being indicative of further evolution.

To say this, however, will convey little to a pupil who has only studied the Gramineae and the Liliaceae among the monocotyledons. The family differs from the Liliaceae in several important ways: in the Commelinaceae the perianth segments form two very distinct whorls, the outer series being calyx-like and the inner petaloid, whereas in the Liliaceae the two whorls are normally very similar; only in the Liliaceae does the normally rhizoid rootstock ever give way to bulbs or corms; and thirdly, taking the family as a whole, the Commelinaceae appear to inhabit semi-aquatic conditions more frequently.

Discussion

The acetocarmine method for studying pollen mother cells was described by Belling as long ago as 1926. Considering the need for easy practical work on chromosomes, it is remarkable how little this technique is used in school biology. Few textbooks seem to cover the subject effectively: nearly all, even the large practical botany textbook by McLean and Ivimey-Cook (1952), expect teachers to rely on complete sections and prepared slides. Barker (1945) discusses methods for the study of mitosis and meiosis at school; but he implies that *Tradescantia* is not an easy experimental material, whereas recent experience at Reading School suggests that it is extremely easy to use, and simpler and quicker to handle than the others he mentions. Acetocarmine preparations of *Tradescantia* first pollen grain mitosis are particularly easy and quick to prepare, and provide as elegant chromosome formations as a student is likely to see: the metaphase plate is relatively flat and only half the somatic number of chromosomes is present, (see Anderson and Sax, 1936). Root-tip and sectioning techniques need more skill and take more time. In addition, students probably find it particularly helpful to be able to follow meiosis, mitosis and many aspects of male gametogenesis in *one* plant: so often they are unnecessarily muddled by having to use different materials for the study of different stages. Shaw (1952) has gone some way towards drawing attention to these facts.

Some stain-fixatives alternative to acetocarmine give better results; but most of them are more difficult to handle and require more work. A possible exception is acetic orcein (La Cour, 1941). Permanent preparations can be made, and technical details are given by Darlington and La Cour (1947); but these are probably not advisable for school purposes, because students may use them instead of preparing temporary mounts for themselves.

Members of the Reading School biology class showed a good deal of enthusiasm for this work. There is considerable satisfaction in being able to introduce pupils to a research technique which they may use themselves. With it they can investigate individually some important aspects of plant sexual reproduction. Because most school textbooks do not mention polysiphony, something of a sensation was caused amongst the Reading pupils by their finding that a *Tradescantia* pollen grain in sugar solution may produce more than one tube. Observations of this sort on living organisms help towards understanding that biology is a practical study, and that a textbook is no substitute for personal observation and experiment.

Acknowledgements

The writers wish to thank Dr. M. L. Johnson of University College, London, Mr. J. E. Dandy of the British Museum (Natural History), and Dr. H. L. K. Whitehouse of Cambridge University Botany School for their helpful comments; and also Mr. H. M. Thomas of Reading School who gave them the opportunity for and encouraged them in this work.

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Beware of Carbon Tetrachloride

JOHN C. MAYFIELD
The University of Chicago

A recent article in ABT describes some of the advantages of carbon tetrachloride as a killing agent[1]. In explaining its action the author says that "it is as poisonous for mammals as it is for insects under similar conditions. The . . . carbon tetrachloride gas quickly fills the bottom of the bottle, floating the oxygen-containing air above it . . . The insect dies for want of oxygen . . ." He says also that two tablespoons of carbon tetrachloride placed in a box will kill a trapped animal "quickly and humanely." Some of these statements seem to say that one need take no more precautions in dealing with carbon tetrachloride than with an equal volume of carbon dioxide gas. Others indicate that the killing action of carbon tetrachloride vapor is much more than a simple smothering effect.

That the latter impression is the correct one is supported by evidence from other sources. *Consumers Research Bulletin* has repeatedly warned of the danger of carbon tetrachloride poisoning when this substance is used as a solvent in dry cleaning and as a fire extinguisher fluid. In May, 1953, the *Bulletin* reprinted an editorial from the *Journal of the American Medical Association* which said that "carbon tetrachloride is potentially toxic on inhalation, on contact with the skin, or mucous membrane, or orally. Toxicity may result from a single brief exposure to a highly concentrated vapor or prolonged, excessive, or repeated exposure . . . Generally, the symptoms and signs of carbon tetrachloride poisoning are similar to the ones appearing in various stages of hepatitis, nephritis, and congestive heart failure.[2] In September, 1954, the *Bulletin* reports a case in which a fire extinguisher carried by a Coast Guard vehicle was jarred loose and spilled a portion of its charge of carbon tetrachloride. As a result one of the men in the vehicle became ill and was hospitalized for more than a month.

From the facts reported above it would appear that biology teachers should use carbon tetrachloride with great care—only in small amounts and outdoors or where the vapor can be quickly dissipated by ventilation through open doors and windows. This care becomes doubly important when they are supervising the use of this dangerous substance by students and student assistants.

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[1]Allen Lake, "Carbon Tetrachloride in the Biology Laboratory." *The American Biology Teacher*, March, 1955, pages 108-109.

[2]From the issue of January 3, 1953.

The Garden Laboratory

MARCELLUS C. MILLER
Phillips High School, Battleboro, North Carolina

Figure 1. The Garden Laboratory

Gardening is a popular hobby in America. Both adults and children are interested in this activity. The ordinary gardener seeks to make his home surroundings attractive while growing beautiful flowers or tasty, fresh vegetables for his table. A garden may range in size from a single flower pot to several acres of land. Such gardens may contain among their populations several or all of the following: trees, shrubs, vegetables, decorative flowers, grasses, weeds and various animals (the least of which are not insect pests).

The enterprising biology teacher might use this interest in gardening to lead his students into a more serious consideration of biological phenomena. This aim need not be achieved at the expense of the interest. On the contrary, the interest in basic biological principles increases the joy of gardening!

One way the biology teacher might use this interest is to foster and guide the cultivation of a garden laboratory. Land for such a laboratory might well be located on the schoolgrounds or in close proximity to them. Usually, the school board or some good citizen will donate such land.

Garden laboratories located on the school premises are ordinarily the most desirable. However, since most schools are closed during part of the gardening season, laboratories at the homes of students or teachers may provide for better care. This is the case here in Battleboro.

In figure one may be seen the garden laboratory discussed in this paper. It is located on two adjacent lots behind the author's home. Some problems studied have been: "How to Replace Kentucky Bluegrass with Winter Rye," "How to Irrigate a Small Garden Properly," "How to Start a Compost Pile" and "To Study What Part Microorganisms Play in Its Formation."

One study, that of the life cycle of the common cabbage caterpillar, developed when it was noticed that these insects were invading some three dozen collard plants which the class had planted. A large number of these insects were collected and incubated individually in small vials at 70 degrees F. The vials were kept on a kitchen shelf and the insects were fed on collard leaves. Some insects were allowed to mature to the butterfly stage while

others were permitted to metamorphose only to the chrysalis stage and still others were not allowed to mature at all. Fifteen per cent formaldehyde was used to preserve the various stages.

Thus, the class was able to make detailed examinations of the various stages in this insect's life cycle and to see these changes take place. Some of the questions arising out of this caterpillar experiment indicate the extent of the enthusiasm generated by it. Such questions as: What are the relationships existing between the caterpillar's protoplasm and that of the plant host? Does photosynthesis take place in the greenish portions of the caterpillar's skin? etc.

One experiment recently completed is, "What effects do various gardening techniques have on the growth of mustard plants?" The manner in which this problem was studied is outlined as follows:

Procedure: Mustard beds, 2 x 20 feet were prepared with equal sized spaces between each bed to act as aeration-irrigation spaces. These spaces were irrigated, worked and fertilized in the same manner as the mustard beds. One mustard bed, the control, was not treated as the others.

Results: Mustard beds given special design and treatment showed growth and development superior to that of the control. In addition, the basket on the bench was filled with greens for sale at the local market. This added some monetary interest to the experiment.

Conclusion: Adjoining aeration-irrigation spaces between beds influence growth of mustard plants.

These examples of uses for a garden laboratory are not intended as a guide. They are presented as representative of the spirit of such work.

FREE PAMPHLETS

Elementary science teachers will find the pamphlets available from the Swift and Company, Agricultural Research Department, Chicago 9, Illinois very helpful. Some of the titles are "The Story of Soil," "The Story of Plants," and "The Story of Grass."

Conservation Education in Indiana

PREVO WHITAKER
University High School, Bloomington, Indiana

One concomitant, if not direct, outcome of the conservation education project carried out by NABT has been the stimulation of interest to a point of action in certain focal areas in the country. Teachers and school laymen have begun to initiate or renew steps arousing an awareness of the importance of conserving our nation's natural and human resources.

In Indiana, as doubtless has been the case in other states, activity centered around the teaching of conservation practices has been intermittent and relatively unorganized. Few persons outside the State Department of Conservation and other professional conservation offices have made any vigorous effort to stimulate the public to an awareness of the problem of our diminishing resources. Such programs as have existed have been unbalanced and sporadic, due to the pressures of certain interest groups and to political interruptions. While the direct recreational aspects of conservation that are provided through the propagation and protection of fish and game and through the park program are certainly laudable approaches, it must be admitted that there has been a paucity of consideration for teaching the underlying principles which are basic to them. Extremely important are the values of appreciation of *living* wildlife, clean streams, and virgin forests. Priceless are the concepts of conservation that, once having been learned, cause us to want to utilize, propagate, preserve, and restore these resources, not only in order that we may have sport or greater economic return, but also that they may be perpetuated, improved, for future generations. These aesthetic aspects of conservation satisfy the deeper needs of human beings. They also, as just indicated, extend the economic productivity of our natural resources.

Evidence accumulated from the Indiana questionnaire to biology teachers in connection with the NABT project indicated an almost universal admission that some conserva-

tion is being taught. Presumably, a large number of the children in our schools are exposed to it. How well the exposure "takes" may perhaps be better judged by observing what evidence of influence one may find in certain isolated communities. That is, can one find evidence that children have carried the lessons in conservation to their parents and neighbors? Yes, such evidence can be found here and there and the prospects are encouraging. Much time is required to fill the gaps between the islands that surround schools where teachers with conservation "know-how" and enthusiasm have worked.

In 1945 the Teacher Training and Licensing Commission of the Indiana State Board of Education passed a ruling that every prospective biology teacher should be required to take an equivalent of three semester hours of conservation training.

Teacher training institutions in the state instituted new courses or geared existing ones to meet this requirement. Purdue University has taken the lead in conservation training for teachers, as well as specialists, and an appealling service to teachers—not only biology teachers, but others as well—is the annual conservation camp which has been conducted by Purdue since 1946.

Approximately three hundred teachers have completed the Conservation Education Camp course that has been conducted each year at Versailles State Park during the summer session.

In 1953 members of the faculty of Indiana University moved to investigate the feasibility of offering a conservation curriculum. A series of conferences was held during the 1953 summer session. A workshop was organized in 1954. In 1955 the workshop was expanded to eighteen days during which the participants lived together at the University's 2200 acre estate, Bradford Woods, near Martinsville, Indiana.

Thus, in a real way, some tangible results have begun to take form in Indiana in conservation education. The NABT project was a large factor in this trend.

The E. Leitz, Inc., famous microscope manufacturer, announces that a new type of micro-manipulator with a single one-hand control of unusual precision is available now from the firm.

Conservation and the City Student

RUSSELL PENGELLY,
Klamath Falls High School, Oregon

With the growing awareness of the public for a greater need for conservation of our national resources there has come a new load to the teacher of general science and biology. This is to teach conservation in some shape or form.

The first time I taught a unit on conservation I followed the text book rather closely. Like most textbooks I have seen, it dealt mainly with the soil and forest. I came to the conclusion after a while that the unit had been, mainly, a waste of time. You see, I teach in a city school system.

We discussed the rotation of crops, contour plowing, sustained yield of forest, etc. Having been raised on a farm and having majored in biology at an agricultural college I had some understanding of these problems. But it occurred to me that these students had little first hand experience of these problems. After leaving school they will have jobs in stores, factories, and offices. The knowledge they did acquire will be of little or no value to them. This type of teaching also gives the students the idea that the farmer and the forester are the only ones who must work at conservation. It does not instill in the minds of the pupils that conservation is the responsibility of all people in all walks of life.

My approach to the subject is now this: We first spend a couple of days discussing what natural resources are and what conservation is. Then I open up with this question: What can we as city people do in the field of conservation? In the field of forestry we learn that about ninety per cent of the forest fires are started by man. We then discuss the camper, the fisherman, the hunter and how most of the fires are caused by carelessness on the part of these people who are largely from the towns and city. In the field of wildlife we discuss the need for people to obey the game laws to insure an adequate supply of animals for reproduction of next year's crop. With

this discussion we bring in some of the problems that those working in the field of conservation are faced with in the management of wildlife and forestry. But always, we point out that those people living in the city have some part, some place, in the overall picture.

It is impossible to go very far with the problems of conservation as they pertain to the individual without getting involved in their economic and political ramifications. These are no doubt one of the most important phases of conservation today. How a public school teacher should handle this is something he must work out for himself. But the students should be made aware of this and made to realize as a city person he has as much to lose or gain as anyone in the country. He should realize that this part of conservation is as important as it is that the farmer conserves his soil.

When one teaches conservation in the city or an urban area he should slant the course to show how conservation affects the individual and how the individual can influence conservation. A teacher using this approach will have to do a great deal of research to get the information he needs, for none of the text books I have seen takes this approach to the subject.

The Use of Liquid Rubber in Making Plaster Models for Science Classes

LeROY SCOTT
Zoology Department
Southern Illinois University
Carbondale, Illinois[1, 2]

In the study of biology, there is an ever-present need for materials and teaching aids which will help the student to understand more fully the material which is being presented. Models are excellent aids to teaching. Commercially prepared models are not always available on the subject which is being taught, and their expense would be prohibitive if each student were to have one. Helping the students to make their own models would provide each student with his own individual set, and the actual procedure would be a meaningful learning experience. The finished product should be one which the student is proud to take home and display.

The process described below is one which is simple enough for the inexperienced student to follow to completion. The cost is almost negligible; so each student should be able to have for his own a copy of each different model made. The usual method of making models of plaster-of-paris in high school science classes requires the student to model the figure in a negative or reverse form in permanently soft modeling clay. The mold must then be thoroughly coated with a thin layer of petroleum jelly and the plaster-of-paris poured in the mold to remain until firm. Upon removing the clay mold from the plaster model, the mold is usually torn apart and broken so that duplicate models cannot be made from the mold. Also, the model is coated with a film of petroleum jelly which must be removed with a solvent before it can be painted. The drawbacks with the method described are (1) the possibility of misjudging proportions while modeling the form in reverse, (2) the greasing of the mold resulting in a greasy model which must be cleaned, and (3) the ability to make only one model from each mold. The process given in the following paragraphs is an attempt to eliminate the defects mentioned above.

To Make the Rubber Mold

Equipment: ¼″ plywood board about 4″ x 6″, a 1″ x 1″ wood strip of molding about 2′ long, nails, hammer, saw, modeling

[1]Present address: Maine Township High School, Des Plaines, Illinois

[2]Supported by Endocrine Research Fund, Southern Illinois University, under the direction of Dr. Charles L. Foote.

clay (permanently soft), glass sheet 10″ x 12″, modeling tools (may be improvised), small ½″ paint brush, petroleum jelly, and liquid latex[3].

Procedure: (1) Select the subject and make sketches of the shape from at least three views—dorsal and two lateral. Indicate the measurements of the base and various other parts. (2) Construct a wood mold to shape the base of the clay (Fig. 1). The mold can be of ¼″ plywood with a removable frame which extends ¾″ above on all four sides. (This step may be omitted if the student can cut an acceptable rectangle of the clay after the modeling is completed). Grease the bottom and sides of the wooden mold to facilitate removal of the clay. (3) Soften a sufficient quantity of permanently soft plastic modeling clay by working it with the hands. Press the soft clay into the wood mold to shape the base and model the desired figure exactly as the finished product is to be (Fig. 1). Be certain that the completed clay model is as smooth as possible. (4) Remove the clay model from the wood mold (or trim if no mold was used), place on a sheet of glass, and apply liquid latex with a small brush or spray. Extend the latex on to the glass about ¼″ around the entire model. Do not grease the model before applying the latex. Allow latex to set and repeat the applications until a thickness of approximately 1/16″ of rubber is attained. (Four to five applications a day for about five days are necessary.) The drying time will vary due to variations of the temperature of the room. It has been observed that the latex sets more quickly in a warm room than in a cool room. (5) Remove carefully the rubber mold from the clay model (Fig. 1). Trim away any rough edges from around the mold.

To Make the Plaster Model

Equipment: Rubber mold, plaster-of-paris, pan and spoon, and water.

Procedure: Do not grease the rubber mold.
(1) Measure the amount of water necessary for mixing plaster by filling the mold with water and emptying it into the pan.

(2) Sprinkle the plaster-of-paris into the water until it no longer sinks below the surface of the water. Stir it carefully to make a smooth mixture. Add more plaster if the mixture is not thick.

(3) Carefully pour the mixture into the rubber mold. Fill it to the top making sure the plaster fills all the parts of the mold.

(4) Allow the plaster to harden and dry. The rubber mold can be removed from the model before a thorough drying has taken place if great care is taken to not damage the damp model.

(5) Repeat the process for the desired number of models.

The models may be painted when dry (Fig. 1). Waterproof enamels are desirable but may be unsatisfactory in a classroom because of the drying time. More than one coat may also be required and the colors run easily if allowed to touch. A quick and easy method of painting is to use tempera paints to which a small amount of liquid soap has been added. The soap permits one to stop and re-start without a line showing where the paint dried. After the tempera paint has dried, a thin coat

Fig. 1. Photographs of models and molds described in text.

[3]RUB-ER-SPRA Liquid Live Latex, Ken-Dor Studio, 949 George St., Lake Geneva, Wisconsin.

of clear shellac will make the model comparatively waterproof. Commercial plastics in a bomb give a quicker and better protective coat which dries almost instantly.[4]

Anthropology and the High School

JACOB W. GRUBER
Assistant Professor of Anthropology
Temple University

Unlike that of many other disciplines which maintain a traditional place in our various educational curricula, the history of anthropology is such as to lead to some immediate pessimism with respect to its inclusion in a high school program. A late starter in the race for specialization, anthropology with its varied interests began as a loose collection of specialized excrescences growing out of the more traditional, older and much more respectable fields of history, anatomy, medicine, religion and biology. As such, the field was designed for specialists interested in particular and often narrowly defined phases of man and his nature which had been neglected in the growth of the traditional disciplines. This situation of anthropology as a collection of specialties rather than a synthesis was particularly true of American anthropology in its earlier phases. A glance at the anthropological offerings of half a century ago reveals that they were exceedingly limited in scope and confined generally to graduate programs. It has only been within the last generation, with the gradual broadening of the western world-view, that anthropology offerings have filtered down into undergraduate programs. But here too the tendency has been to affiliate anthropology courses and contributions with other older and more traditional fields.

This filtering down process makes it difficult to discuss the role which anthropology can play on the high school level. Anthroplogy still remains a specialized branch of knowledge drawing upon the data of many other disciplines for the construction of its concepts with respect to both the physical and cultural nature of man. There has been, however, a quickening of a tendency for the extension, redefinition and diffusion of concepts within the field. This gives promise of a synthesis of ideas in the study and understanding of human behavior. Despite the still highly specialized nature of much of the anthropological data and approach, I, as an anthropologist, am aware of the necessity for making available on a high school level certain of the points of view which are the products of this synthesizing tendency. These are points of view which can and should serve as background phenomena upon which the high school student can build a more comprehensive and less parochial world-view. Such a broadening of perspectives is to me a requirement for existence in the contemporary world.

On the one hand, therefore, anthropology as a body of data would seem to be too complex to be handled successfully and meaningfully on the high school level. On the other hand, however, the points of view to which these data lead are one valuable component of high-school preparation if we assume that one of the objectives of that education is the preparation of individuals intellectually equipped to participate fully in modern adult society.

The solution of this paradox I think lies in the stress within a high school program of certain broad theses or approaches which have been traditional to anthropology as a science.

The first such thesis is one with respect to an understanding of man's place in nature. The whole tendency of western thought until recent times has been to make a man a distinct and unique entity within the universe however that universe may be defined, and stressing man's separateness from the world he inhabits. Such a tendency can and has led to two antithetical extremes. If one carries out the logic of man's separateness one may reach the transcendental goal of man's spirituality as the only aspect of his being of any importance; or one may come to see man himself as the sole being of importance, the dominant being in the universe. The first path leads to an earth-forsaking otherworldliness of the religious mystic; the second to an unwarranted confidence in man's powers and independence

[4]KRYLON CRYSTAL CLEAR SPRAY 1301, Krylon, Inc. 2038 Washington Ave., Philadelphia 46, Pa.

which sometimes goes by the ill-defined term of atheism. A proper perspective on man's place in nature can serve to curb the excesses of both extremes. And it is such a perspective which an understanding of certain fundamental contributions of physical anthropology can construct. A century of concern by anthropologists with the "man problem" has brought forth a considerable amount of data with respect to man's place in nature. We are today on much firmer ground than that upon which were founded the hopes of a Huxley or the positive pronouncements of a Haeckel.

The use by anthropologists of the fast-accumulating data from genetics; the acceleration of palaeontological research which has led to the significant recent discoveries in East and South Africa; and the more sophisticated approaches to comparative psychology, physiology and anatomy; and finally, the promise of reliable dating techniques through recent work on radioactive materials—all these developments make possible the construction of a frame of reference within which man can be viewed in his natural relationships with the rest of organic nature. Neither to know nor to understand the implications of such a frame of reference—no matter the belief system to which one subscribes—is to miss entirely one of the significant contributions of modern science to the world view of contemporary man.

A second thesis is the recognition of the place which western society occupies with reference to humanity as a whole. If a recognition of man's place in nature provides modern man with a broadened time perspective, a recognition of the extreme variations—as well as the uniformities—in social behavior provide western man with a broadened perspective in space. Except for occasional bows in the direction of an oversimplified human geography, our schools tend to create a cultural parochialism which can only be regarded as a primitive vestige in a world which has shrunk so small. For the American soldier dispersed throughout the world during the second World War, the peoples and the cultures he met were shocking. He had been led to believe that the world was peopled by imperfect copies of the American, copies which he had met much earlier in a children's literature which includes *The Eskimo Twins*, *The Chinese Twins*, etc. The intense—and deep—cultural variation with which he came in contact belied to him, if he thought of it at all, the universality of the American image. That such differences in behavior could exist as efficient and respectable mechanisms of adaptation was beyond the comprehension which his educational experiences had constructed. It is this recognition of the basic dissimilarities—as well as the equally fundamental and significant uniformities—in the behavioral systems of the many peoples of the world which is a fundamental requirement for a rational existence in the modern world. The preachments of understanding and tolerance, backed by little more than feeling, have not proved in the past, nor are they apt to prove in the future, effective means by which to attain a common ideal of world understanding and cooperation. The culture of any society is the most demanding environment to which man must adapt; it is the skelton upon which every society is built.

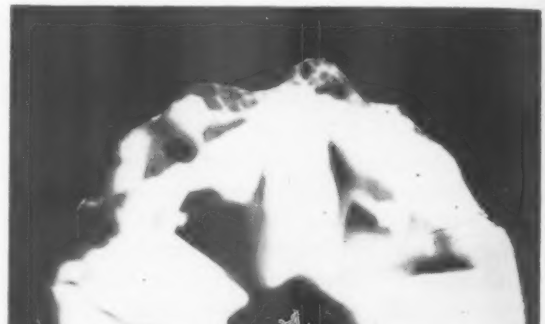
And finally there is a third thesis: the recognition of the peculiar nature of man himself within his own dimension, the human dimension. Man is the most remarkable of animals for, while an animal, his whole behavior is designed to nullify that fact. Notwithstanding his attempts to de-animalize himself, it is important for his own self-conception and self-awareness that he realize the nature of the animal within him. Not to understand the animal basis of so many of his problems and so much of his behavior is to distort his own understanding of himself. We need not resurrect the age-old mind-body problem to recognize that human behavior, whatever its neurological bases, is designed to fit an animal structure to a physical environment. We need not dehumanize man to recognize that much of his behavior is understandable only in terms of his organic structure. We need no parochial philosophical position to recognize that a human mind in a dog's body would result in a behavioral complex quite different from that which we ordinarily define as human. This recognition of the close relationship between human behavior or culture and human organic structure, the interweaving of the two into a consistent picture of man, is certainly one of most important contributions which anthropology can make to the layman.

If these theses are such as to have relevance to a high school program—and I feel we do our students and our society a disservice by excluding them—the problem lies in the means of introduction. Certainly a detailed treatment of the sparse fossil representatives of man's putative past is unnecessary, as is a detailed description of family life in various societies. These theses, however, do represent a point of view, a frame of reference within which man can be viewed with the broadest of perspectives. And it is the frame of reference that is important. It requires no detailed knowledge of the anthropological data for a teacher of biology to awaken the curiosity of his students to the obvious structural similarities between man and others of the animal kingdom nor to raise the questions which must inevitably follow from the recognition of such similarities. Nor does one require a familiarity with the extensive literature on culture for him to recognize and stimulate the curiosity of his students in the quite significant differences between man and the rest of organic nature. The human hand itself is an excellent example of the problem. Here is an organ which is not uniquely human, shared as it is with the rest of the Primate order. And yet, that hand on a human frame and under the control of a human nervous system performs in a manner quite distinct from that of the chimpanzee, the gorilla or the monkey. And yet think of all that man could not accomplish—all that he assumes as his natural right—were it not for the hand. In the hand we see the ancestry of man as well as his uniqueness.

Much of what I have written here is perhaps commonplace in many schools and in many curricula; and yet the greatest number of our high school graduates—those who come to college and those who don't—have nothing but a provincial, egocentric, man-centered conception of their own nature. Theirs is a stable universe with man at the center, the epitome of creation. The dynamic view of man—which each of us implicitly assumes as we ourselves continually move and change—is so diffuse and uncrystallized as to be completely overshadowed by a view of stability which though it may provide an immediate mental security is nonetheless illusory. T. H. Huxley used to excite and stimulate his listeners through the use of a piece of chalk as a take-off point from which he could construct the universe in its infinite relatedness. What we require today is the use of that much more complex entity known as man for the same purpose.

Aristotle's Lantern

ARTHUR H. BRYAN
Baltimore City College
Baltimore, Maryland



In the phylum Echinodermata, class Echinoidae, are grouped the sea urchins (Asthenosoma) and the sand dollars.

The spiny sea urchin has one of the most interesting and complex masticating structures in the animal kingdom, namely, the Aristotle's Lantern. It can be readily dissected from the oral surface of a sea or heart urchin by any biology student who has some insatiable curiosity.

The mouth part of the sea urchin's lantern consists of five white triangular, pointed teeth which function in grinding and grasping plant or animal plankton food. There are five basic sockets with fifteen other calcareous figures surrounding the pharynx. These are activated by curtain-like muscle bands which

move five pillars and set the whole complex calcareous mosaic in motion.

If the Aristotle's Lantern is carefully dissected amazing geometrical figures and patterns are revealed. There are circles, anchors, triangles, pillars, pyramids, in pure white outline, contrasting with the thin, red muscular curtains which move them.

With a little archeological imagination we might conclude that some of the ancient architectural designs such as Oriental, Grecian, Egyptian, Roman, and Corinthian may have been inspired by the mouth and pharyngeal parts of the lowly sea urchins, Aristotle's Lantern which can be revealed in all its intricate beauty with a simple magnifying glass.

A chemical which makes cells divide has been isolated in a pure form by University of Wisconsin scientists. Called kinetin, it is obtained from DNA, an important component of chromosomes. This chemical used in traces in tissue cultures seems to stimulate cell division.

A "vest-pocket" size version of a well known pocket comparator is now being sold by one of our advertisers, the Edmund Scientific Corporation. The instrument is used to compare hole diameters and take linear measurements of microscopic proportions.

Audio-Visual News

EMERY L. WILL
State University Teachers College,
Oneonta, New York

The study and management of upland watersheds is a conservation topic now receiving well-deserved attention from film producers. During the past few years, the University of Nebraska's VALLEY OF STILL WATERS has been shown widely at conservation workshops. In early 1955, Coronet announced the release of THE MAKING OF A RIVER, which was produced by the Conservation Foundation. From Washington, D. C., we note that THE WATERS OF COWEETA has been in considerable demand from the U. S. Forest Service. The Soil Conservation Service has released an eleven-minute, black-and-white film, UPSTREAM WHERE THE FLOODS BEGIN, and is completing the editing of FROM THE RIDGE TO THE RIVER.

The USDA informs us that the negative of REALM OF THE WILD, which has proved itself an outstanding wildlife film, is rapidly deteriorating and soon will be unusable for further printing. If you wish to purchase a print, it is suggested that you make your request to United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

Newest listings of Department of Agriculture film materials are: Agriculture Handbook No. 14, "Motion Pictures of the U. S. Department of Agriculture" (1954); Agriculture Handbook No. 87, "Film Strips of the U. S. Department of Agriculture" (1955); Copies of the former handbook are available for $.25 from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

The Motion Picture Service of the USDA offers a stock scene library service to groups and individuals interested in using agricultural film footage in the production of films and television programs. Four issues of the "TV Film Clip Library Scene List now are available upon request to the U. S. Department of Agriculture, Office of Information, Motion Picture Service, Washington 25, D. C.

Requests for assistance in the production of television programs have been received by the Audio-Visual Committee. With your coopera-

tion, we could set up a clearing house for biological program ideas, sample scripts, and special techniques. We would like to know what YOU are doing with educational television at your institution, and if any of you would be interested in helping compile materials for such a clearing house or for a proposed article in the ABT. A post card or letter addressed to the Audio-Visual Committee of the N.A.B.T., in care of Dr. Emery L. Will, State University Teachers College, Oneonta, N. Y., would help determine a course of action. Please let us hear from you.

Available either in black-and-white or in color, THE COMPOUND MICROSCOPE is proving a welcome means for introducing classes to the parts and functions of microscopes. Bausch & Lomb also have produced a students' manual which serves as an excellent preview and follow-up for the actual film showing. For your free booking of this fine film, write well in advance to Bausch & Lomb Optical Co., 635 St. Paul Street, Rochester 2, N. Y.

About 30 species of trees are shown season by season in Dr. William Harlow's newest film release, TREE PORTRAITS. Of particular interest to teachers in the northeastern states, the film shows how to identify trees by their leaves, flowers, fruits, twigs, buds and bark. Time-lapse scenes of trees in the spring, and data on the importance and distribution of trees in New York State are included. Address inquiries to Dr. Harlow at the State College of Forestry, Syracuse University, Syracuse 10, N. Y.

Here are a few recent film releases:

FLOWERING DESERT. 11 min., sd., color. The desert and its climates; the coming of spring to the desert fauna and flora. Bailey Films, 6509 De Longpre Avenue, Hollywood 28, California.

THE GRASSHOPPER: A TYPICAL INSECT. 6 min., sd., color. Body structure, life cycle and economic importance. Intermediate to junior high. Coronet Films, 65 E. South Water Street, Chicago 1, Illinois.

THE HONEYBEE: A SOCIAL INSECT. 6 min., sd., color. Communal living, division of labor, life cycle and economic importance. Intermediate to junior high. Coronet.

THE BUTTERFLY. 6 min., sd., color. Life cycle and identification techniques. Intermediate to junior high. Coronet.

LET'S TAKE A WALK ALONG THE BROOK. 10 min., sd., color. Story of a field trip for young children. Primary. Gateway Productions, 1859 Powell Street, San Francisco 11, California.

WORLD OF LITTLE THINGS. 15 min., sd., color. Microscopic plant and animal life, viewed with the aid of the microscope and time-lapse photography. Junior and senior high. Moody Institute of Science, Educational Film Division, 11428 Santa Monica Boulevard, West Los Angeles 25, California.

A SEXUAL REPRODUCTION. 11 min., sd., color. Fission, various outgrowths and spores are used to illustrate this type of reproduction, in plants and animals. Senior high. Audio-Visual Center, Indiana University, Bloomington, Indiana.

EMBRYONIC DEVELOPMENT No. 1—THE CHICK. 26 min., sd., color or b & w. Shows step-by-step development of chick embryo, through animated diagrams and cinemicrography of the living embryo. Time-lapse sequences are included. Senior high and college. From National Film Board of Canada, but distributed by Contemporary Films, Inc., 13 East 37th Street, New York 16, N. Y.

Handbook for Teaching Conservation and Resource Use Now Available

The best means of helping children understand the importance of our natural resources are expertly described by the teachers in the "Handbook for Teaching Conservation and Resource Use," a 500 page illustrated book, just completed by the National Association of Biology Teachers.

The publication was prepared by two hundred teachers from thirty states, and shows how they have incorporated conservation and resource-use teaching into the schools. The "How to Do It Stories" and 82 pictures will help other teachers and youth leaders see "How to Get Started," "Where to Get Help," "What to Do in the Classroom," "How to Use the School Grounds and the Community," and how to develop such projects as school forests, school gardens, school camps, wildlife sanctuaries, outdoor laboratories, nature trails, and museums.

The material for the Handbook has been collected by the National Conservation Com-

mittee of the National Association of Biology Teachers since 1951 under the direction of Dr. Richard L. Weaver, the Project Leader, from the School of Natural Resources of the University of Michigan. The four-year project was financed by a grant from the American Nature Association.

The Handbook is available through the office of Dr. Weaver, P. O. Box 2073, Ann Arbor, Michigan, at a cost of $4.00, with a twenty per cent discount to schools. The proceeds wil be used by the National Committee to continue its conservation education activities in the various states.

Autumn Leaves for the Thanksgiving Table

HELEN FIELD WATSON
Northfield, Minnesota

Autumn glow is so heartening, so amazing, that we walk beneath hard maples with a new erectness. And when their brilliant leaves begin to fall we walk as in a dream, not knowing where to look. Above us and around us and beneath our feet the world is ablaze with vivid reds and yellows.

We want to carry this dream with us; we want to continue to live in an ectasy of color. So we pick up the loveliest of the fallen leaves; then others which seem lovelier. Farther on are brighter ones. When we reach home with a fistful of colored leaves the family, each in turn, says, "Aren't they beautiful!"

By the next day these leaves have begun to curl and to lose their glowing colors. How can you preserve them?

In our home we have experimented with hard maple (*Acer saccharum*) leaves only, so the information given here may not apply generally. And the methods suggested do not produce proper botanical specimens. But experiments are fun, so why not try these suggestions on maple leaves and others also.

(1) One successful method is to inclose the leaves singly between a fold of paraffined paper and press with a not-too-hot iron on both sides until the paraffin has melted onto the leaves. Remove them from the paper and let them dry. After a day or two they have wrinkled slightly but only enough to appear more natural than pressed leaves. The color remains reasonably true.

(2) The other method we have used is not new either. Several years ago I saw an interesting exhibit in Boston of dried garden flowers including sweet peas, snapdragons, roses, pansies, and others. These had been prepared by imbedding each spray in some one of the common household powders for several weeks. The powder had been carefully sifted into each flower between its pistils, stamens, petals, and sepals and around the leaves. The powder aids in the drying. The specimens had been dusted off after weeks in the powder and were in many cases almost as true in color as the living flowers.

We tried this method this year with October maple leaves. On some we used talcum powder, some starch, others soda. The brand of talcum we used did not preserve the color well. The leaves had a soft muted rose tint.

Corn starch worked very well indeed, the vivid reds, maroons, and yellows being almost as good as if the leaves were just picked from the tree. And the leaves are nearly flat.

One of the most successful powders was baking soda. Again, the October reds and yellows were there after being imbedded four or five weeks in the soda. And weeks after being removed from the powder they retained their color and their flatness.

Autumn leaves are naturally far easier to preserve than spring leaves or frail flowers as much drying has gone on by fall. Sprinkle powder under and over each leaf. Place in a small box and set away uncovered (with some slight weight above), for four or five weeks. Later, when you remove the leaves and dust off the powder you find little undulations between the veins which are natural to fresh leaves, and a color difficult to retain in pressed leaves, no matter how carefully done.

Autumn leaves prepared in one of these ways and used to decorate your Thanksgiving table will cause your guests to exclaim, "How did you keep them!" This is both an exclamation and a question.

Program

National Association Of Biology Teachers

ANNUAL MEETING
DECEMBER 26-29, 1955
ATLANTA, GEORGIA

Monday Afternoon, December 26

3:30 p.m.: Meeting of Board of Directors, NABT, Panel Room A-B, Dinkler Plaza Hotel

Monday Evening, December 26

7:30 p.m.: Meeting of Board of Directors, NABT, Panel Room A-B, Dinkler Plaza Hotel

Tuesday Morning, December 27

8:00 a.m.: Presentation of Science Teaching Films. Arranged by Emery L. Will, State University Teachers College, Oneonta, New York

9:00 a.m.: Joint Session of ANSS, NABT, NSTA. Arranged by ANSS

Tuesday Afternoon, December 27

2:00 p.m.: Concurrent Session of NABT; Dinkler Room B, Dinkler Plaza Hotel. Theme: The Coordination of Science and Education. Arranged by NABT

EDNA HIGBEE, First Vice Pres., NABT, Presiding

1. Some Variations with Biology Experiments. NED E. BINGHAM, University of Florida
2. Gearing the Summer Session for the Experienced Biology Teacher. VICTOR A. GREULACH, University of North Carolina
3. Progress Report of the Implementation of the Recommendations of the Southeastern Conference on Biology Teaching.

Panel Discussion.

GEORGE W. JEFFERS, Longwood College, Va., Moderator

Panel Members from State Teams

Alabama—FATHER P. H. YANCEY, S. J., Spring Hill College

Florida—W. HUGH STICKLER, Florida State University

George—W. B. BAKER, Emory University

Kentucky—WILLIAM B. OWSLEY, Morehead State College

Louisiana—W. G. ERWIN, Northwestern State College

Mississippi—R. L. CAYLOR, Delta State College

North Carolina—F. RAY DERRICK, Appalachian State Teachers College

South Carolina—HARRY W. FREEMAN, University of South Carolina

Tennessee—W. W. WYATT, University of Tennessee.

Virginia—G. W. JEFFERS, Longwood College

Tuesday Evening, December 27

8:00 p.m.: Joint Session of ANSS, NABT, NSTA; Rainbow Roof, Dinkler Plaza Hotel. Arranged by NSTA

Wednesday Morning, December 28

8:00 a.m.: Presentation of Science Teaching Films. Arranged by EMERY L. WILL, State University Teachers College, Oneonta, New York

9:00 a.m.: Joint Session of ANSS, NABT, NSTA; Dinkler Room B, Dinkler Plaza Hotel. Arranged by NABT

Theme: Science and Human Resources. BROTHER H. CHARLES, F.S.C., President, NABT, St. Mary's College, Winona, Minnesota, Presiding.

1. The Effects of Science Education in Meeting the Needs of the South. ROBERT B. PLATT, Emory University
2. The Teaching and Use of Radioisotopes in High School Science. DONALD SMITH, Special Training Division, Oak Ridge Institute of Nuclear Studies.
3. A Mid-Century Commentary on Problems Faced by Racially Segregated Schools in Their Efforts to Develop Science Curricula Including the Curriculum for preparing Science Teachers. E. K. WEAVER, Atlanta University
4. Some Recent Progress in the Field of Health and Health Education. DONAL MARTIN, U. S. Communicable Disease Center

Wednesday Afternoon, December 28

2:00 p.m.: Joint Session, Plaza Room, Dinkler Plaza Hotel

Symposium: Research in Science Education. Sponsored by NARST and co-sponsored by all teaching societies.

Wednesday Evening, December 28

8:00 p.m.: Conservation Project Report, Panel Room A-B, Dinkler Plaza Hotel. Arranged by NABT

RICHARD L. WEAVER, University of Michigan, Presiding

Thursday Morning, December 29

9:00 a.m.: General Session; Dinkler Plaza Room, Dinkler Plaza Hotel

Symposium: The Shortage of Scientist. General Session of AAAS. Sponsored by all Societies. Arranged by AAAS

Thursday Afternoon, December 29

1:40 p.m.: Inauguration of NABT Officers; Dinkler Room B, Dinkler Plaza Hotel. BROTHER H. CHARLES, F.S.C., St. Mary's College, Presiding

2:00 p.m.: Concurrent Session 2. Dinkler Room B. Dinkler Plaza Hotel

Theme: Some New Ideas for the Biology Teacher.

Session of NABT. Arranged by NABT. JOHN P. HARROLD, Midland Senior High School, Midland, Michigan, Presiding

1. A New Technique for Growing Fern Spores. ROBERT C. MCCAFFERTY, Central High School, Wadsworth, Ohio
2. Laboratory Animals and Environmental Study. EDWARD M. RAY, Superintendent, Higgins Lake Training School, Michigan Department of Conservation
3. "Ask the Biologist," a Radio Program for High School Students. RICHARD R. ARMACOST, Purdue University
4. Some Trends in the Use of Audio-Visual Aids in Teaching Biology. EMERY L. WILL, N. Y. State Teachers College, Oneonta
5. The Use of Plants in Field Work and the Laboratory. HOLLIS J. ROGERS, The Woman's College of the University of North Carolina
6. The Project Method of Teaching Biology. LUTHER S. WEST, Northern Michigan College of Education, Marquette, Michigan

Thursday Evening, December 29

7:30 p.m.: Business Meeting NABT, Panel Room A-B, Dinkler Plaza Hotel

Friday Morning, December 30

8:30 a.m.: Field Trip to Granite Outcrops. Sponsored by ANSS, ANBT. Co-sponsored by NSTA

Tours at Communicable Disease Center. Sponsored by NSTA. Co-sponsored by ANSS, NABT

Biology in the News

BROTHER H. CHARLES, F.S.C.
Saint Mary's College
Winona, Minnesota

HOW SAFE ARE SCHOOL LUNCHES?, Alice Lake, *Redbook*, October 1955, pp. 32-33, 92-94.

School cafeterias feed millions of children. How sanitary is your school kitchen and cafeteria? What precautions do the food handlers take to insure safe food for you? If handled sanely this article can excite some worthwhile discussion and action.

WITCH DOCTORS AND YOUR HEALTH, George W. Groh, *Cosmopolitan*, October 1955, pp. 116-119.

Drugs extracted from plants used by the medicine men of savage tribes are being used to relieve many diseases. This is an account of the activities of scientists who are scouring the jungles to find the "wonder drugs" of tomorrow.

PLAN TO GET LOST, C. B. Crosby, *Outdoor Life*, October 1955, pp. 72-75.

Information in this article could save your life. If you are prepared and have sufficient knowledge of the out-of-doors you can travel in open country without fear.

MOST DANGEROUS QUARRY, Edwin Way Teale, *Outdoor Life*, October 1955, pp. 66-71.

Pictures and descriptions of a man and his dog who specialize in capturing diamond back rattle snakes.

THE WORLD'S BIGGEST THIRST, Henry LaCossitt, *Sat. Evg. Post*, September 10, 1955, pp. 31, 158-160.

The city of New York requires billions of gallons of water each day. The problem of supply of pure water is a great problem in any large city. How does the water system in your city compare with that in New York?

WHY ANIMALS DON'T NEED MAPS, Ben Pearse, *Sat. Evg. Post*, Oct. 1, 1955, pp. 43, 62-66.

How does an animal find its way home? What organs are involved in the process?

(Continued on next page)

AAAS Meeting in Atlanta, Georgia

The 122nd meeting of the American Association for the Advancement of Science will be held in Atlanta, Georgia, December 26-31, 1955. The four teaching affiliates—National Science Teachers Association, American Nature Study Society, National Association of Biology Teachers and National Association for Research in Science Teaching, will hold a joint conference. The Dinkler Plaza will be headquarters for the conference.

A varied and interesting program featuring nationally-known scientists and science teachers, is being planned. The program includes S. M. Christian, RCA laboratories; Robert T. Lagemann, Vanderbilt; Robert Carleton, NSTA; Dr. John A. Swartant, Oak Ridge National Laboratories; Sara Menaboni, co-author, "Menaboni's Birds"; and many other well-known personalities.

There will be sections of special interest to elementary as well as high school and college teachers. A special attraction will be the large-scale exhibits of the AAAS Exposition of Science and Industry and the AAAS Science Theater.

Biology in the News

(Continued from page 234)

These questions have bothered people for centuries. This article does not have the answers but it is packed with interesting data about the homing-ability of animals.

LAND OF GIANTS, Don Eddy, *American Magazine*, October 1955, pp. 34-37.

Students cannot read this interesting travelog without realizing how much pleasure is in store for the tourist who is wise enough to observe living things in their natural habitats.

Books for Biologists

CONTRIBUTIONS TO PLANT ANATOMY. Bailey, Irving W. The Chronica Botanica Co., Waltham, Mass. 259 pp. 1954. $7.50.

An excellent reconnaissance of Irving Bailey's lasting contributions to botanical knowledge. The pages in this book have been selected to bridge the gaps between Plant Anatomy and other fields of scientific endeavor. Although these papers are limited in scope they should be a source of inspiration to anyone interested in Plant Anatomy.